SLOVENSKI STANDARD
SIST EN 16603-60-20:2014

01-november-2014

Vesoljska tehnika - Terminologija na področju senzorjev za zaznavanje zvezd in tehnične specifikacije

Space engineering - Star sensor terminology and performance specification

Raumfahrttechnik - Terminologie und Leistungsspezifikation für Sternensensoren

Ingénierie spatiale - Spécification des performances et terminolodie des senseurs stellaires

Ta slovenski standard je istoveten z: **EN 16603-60-20:2014**

ICS:

49.140	Vesoljski sistemi in operacije	Space systems and operations

SIST EN 16603-60-20:2014 **en,fr,de**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 16603-60-20

September 2014

ICS 49.140

English version

Space engineering - Star sensor terminology and performance specification

Ingénierie spatiale - Specification des performances et terminolodie des senseurs stellaires

Raumfahrttechnik - Terminologie und Leistungsspezifikation für Sternensensoren

This European Standard was approved by CEN on 1 March 2014.

CEN and CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN and CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN and CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN and CENELEC members are the national standards bodies and national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.

CEN-CENELEC Management Centre:
Avenue Marnix 17, B-1000 Brussels

Ref. No. EN 16603-60-20:2014 E

Table of contents

Figures

Tables

Foreword

This document (EN 16603-60-20:2014) has been prepared by Technical Committee CEN/CLC/TC 5 "Space", the secretariat of which is held by DIN.

This standard (EN 16603-60-20:2014) originates from ECSS-E-ST-60-20C Rev. 1.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by March 2015, and conflicting national standards shall be withdrawn at the latest by March 2015.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

This document has been developed to cover specifically space systems and has therefore precedence over any EN covering the same scope but with a wider domain of applicability (e.g. : aerospace).

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

In recent years there have been rapid developments in star tracker technology, in particular with a great increase in sensor autonomy and capabilities. This Standard is intended to support the variety of star sensors either available or under development.

This Standard defines the terminology and specification definitions for the performance of star trackers (in particular, autonomous star trackers). It focuses on the specific issues involved in the specification of performances of star trackers and is intended to be used as a structured set of systematic provisions.

This Standard is not intended to replace textbook material on star tracker technology, and such material is intentionally avoided. The readers and users of this Standard are assumed to possess general knowledge of star tracker technology and its application to space missions.

This document defines and normalizes terms used in star sensor performance specifications, as well as some performance assessment conditions:

- sensor components
- sensor capabilities
- sensor types
- sensor reference frames
- sensor metrics

1 Scope

This Standard specifies star tracker performances as part of a space project. The Standard covers all aspects of performances, including nomenclature, definitions, and performance metrics for the performance specification of star sensors.

The Standard focuses on performance specifications. Other specification types, for example mass and power, housekeeping data, TM/TC interface and data structures, are outside the scope of this Standard.

When viewed from the perspective of a specific project context, the requirements defined in this Standard should be tailored to match the genuine requirements of a particular profile and circumstances of a project.

This standard may be tailored for the specific characteristics and constraints of a space project in conformance with ECSS-S-ST-00.

2
Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this ECSS Standard. For dated references, subsequent amendments to, or revision of any of these publications, do not apply. However, parties to agreements based on this ECSS Standard are encouraged to investigate the possibility of applying the more recent editions of the normative documents indicated below. For undated references, the latest edition of the publication referred to applies.

EN reference	Reference in text	Title
EN 16601-00-01	ECSS-S-ST-00-01	ECSS system – Glossary of terms

3 Terms, definitions and abbreviated terms

3.1 Terms from other standards

For the purpose of this Standard, the terms and definitions from ECSS-S-ST-00-01 apply. Additional definitions are included in Annex B.

3.2 Terms specific to the present standard

3.2.1 Capabilities

3.2.1.1 aided tracking

capability to input information to the star sensor internal processing from an external source

NOTE 1 This capability applies to star tracking, autonomous star tracking and autonomous attitude tracking.

NOTE 2 E.g. AOCS.

3.2.1.2 angular rate measurement

capability to determine, the instantaneous sensor reference frame inertial angular rotational rates

NOTE Angular rate can be computed from successive star positions obtained from the detector or successive absolute attitude (derivation of successive attitude).

3.2.1.3 autonomous attitude determination

capability to determine the absolute orientation of a defined sensor reference frame with respect to a defined inertial reference frame and to do so without the use of any a priori or externally supplied attitude, angular rate or angular acceleration information

3.2.1.4 autonomous attitude tracking

capability to repeatedly re-assess and update the orientation of a sensor-defined reference frame with respect to an inertially defined reference frame for an extended period of time, using autonomously selected star images in the field of view, following the changing orientation of the sensor reference frame as it moves in space

NOTE 1 The Autonomous Attitude Tracking makes use of a supplied a priori Attitude Quaternion, either provided by an external source (e.g. AOCS) or as the output of an Autonomous Attitude Determination ('Lost-in-Space' solution).

NOTE 2 The autonomous attitude tracking functionality can also be achieved by the repeated use of the Autonomous Attitude Determination capability.

NOTE 3 The Autonomous Attitude Tracking capability does not imply the solution of the 'lost in space' problem.

3.2.1.5 autonomous star tracking

capability to detect, locate, select and subsequently track star images within the sensor field of view for an extended period of time with no assistance external to the sensor

NOTE 1 Furthermore, the autonomous star tracking capability is taken to include the ability to determine when a tracked image leaves the sensor field of view and select a replacement image to be tracked without any user intervention.

NOTE 2 See also 3.2.1.9 (star tracking).

3.2.1.6 cartography

capability to scan the entire sensor field of view and to locate and output the position of each star image within that field of view

3.2.1.7 image download

capability to capture the signals from the detector over the entire detector Field of view, at one instant (i.e. within a single integration), and output all of that information to the user

NOTE See also 3.2.1.8 (partial image download).

3.2.1.8 partial image download

capability to capture the signals from the detector over the entire detector Field of view, at one instant (i.e. within a single integration), and output part of that information to the user

NOTE 1 Partial image download is an image downloads (see 3.2.1.7) where only a part of the detector field of view can be output for any given specific 'instant'.

NOTE 2 Partial readout of the detector array (windowing) and output of the corresponding pixel signals also fulfil the functionality.

3.2.1.9 star tracking

capability to measure the location of selected star images on a detector, to output the co-ordinates of those star images with respect to a sensor defined reference frame and to repeatedly re-assess and update those co-ordinates for an extended period of time, following the motion of each image across the detector

3.2.1.10 sun survivability

capability to withstand direct sun illumination along the boresight axis for a certain period of time without permanent damage or subsequent performance degradation

NOTE This capability could be extended to flare capability considering the potential effect of the earth or the moon in the FOV.

3.2.2 Star sensor components

3.2.2.1 Overview

Figure 3-1 shows a scheme of the interface among the generalized components specified in this Standard.

NOTE Used as a camera the sensor output can be located directly after the pre-processing block.

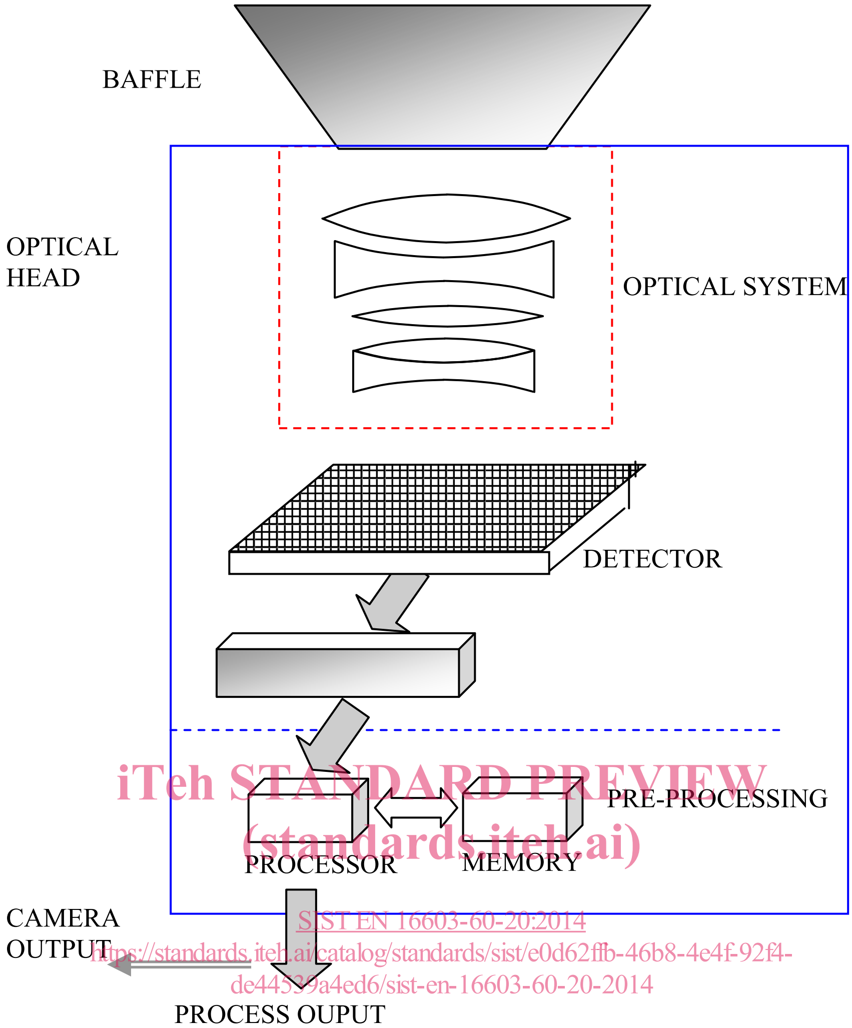

Figure 3-1: Star sensor elements – schematic

3.2.2.2 baffle

passive structure used to prevent or reduce the entry into the sensor lens or aperture of any signals originating from outside of the field of view of the sensor

NOTE Baffle design is usually mission specific and usually determines the effective exclusion angles for the limb of the Earth, Moon and Sun. The Baffle can be mounted directly on the sensor or can be a totally separate element. In the latter case, a positioning specification with respect to the sensor is used.

3.2.2.3 detector

element of the star sensor that converts the incoming signal (photons) into an electrical signal

NOTE Usual technologies in use are CCD (charge coupled device) and APS (active pixel sensor) arrays though photomultipliers and various other technologies can also be used.

3.2.2.4 electronic processing unit

set of functions of the sensor not contained within the optical head

NOTE Specifically, the sensor electronics contains:

- sensor processor;
- power conditioning;
- software algorithms;
- onboard star catalogue (if present).

3.2.2.5 optical head

part of the sensor responsible for the capture and measurement of the incoming signal

NOTE As such it consists of

- the optical system;
- the detector (including any cooling equipment);
- the proximity electronics (usually detector control, readout and interface, and optionally pixel pre-processing);
- the mechanical structure to support the above.

3.2.2.6 optical system

system that comprises the component parts to capture and focus the incoming photons

NOTE Usually this consists of a number of lenses, or mirrors and filters, and the supporting mechanical structure, stops, pinholes and slits if used.

3.2.3 Reference frames

3.2.3.1 alignment reference frame (ARF)

reference frame fixed with respect to the sensor external optical cube where the origin of the ARF is defined unambiguously with reference to the sensor external optical cube

NOTE 1 The X-, Y- and Z-axes of the ARF are a right-handed orthogonal set of axes which are defined unambiguously with respect to the normal of the faces of the external optical cube. Figure 3-2 schematically illustrates the definition of the ARF.

NOTE 2 The ARF is the frame used to align the sensor during integration.

NOTE 3 This definition does not attempt to prescribe a definition of the ARF, other than it is a frame fixed relative to the physical geometry of the sensor optical cube.